PETROGRAPHY.[1]

The Serpentines of San Francisco.—The serpentine of the Protero, a district within the limits of the city of San Francisco, is an eruptive rock intrusive in sandstone. It was originally a lherzolite, which by the usual processes of alteration has been changed to serpentine. Two varieties of the rock are noticed by Palache.[2] One is a massive form, while the other is slickensided along so many planes close together that the rock has became schistose. Between the slickensided surfaces are often spheroidal masses of the massive rock. The massive serpentine is of the usual character. It consists now of a felt of serpentine fibres in which are imbedded numerous crystal-like areas of enstatite and diallage, and grains of olivine, magnetite and chromite. The crystal-like particles of the pyroxenes are remnants of larger grains that were shattered by dynamic action. The pyroxenes and the olivine have yielded the serpentine. Intrusive into the serpentine is a hypersthene diabase, composed of labradorite, monoclinic and orthorhombic pyroxenes and green hornblende, supposed to be derived from the pyroxene. Its structure is ophitic. A second variety of the rock consists essentially of plagioclase and hornblende. Portions of it are schistose. Its structure is sometimes granitic and sometimes ophitic, and in the latter case it contains small quantities of pyroxene. Hence it is regarded as an altered form of the diabase. An analysis of the hornblende variety follows:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	TiO_2	H_2O	Total
47.41	16.03	2.66	7.05	tr	12.33	5.81		4.47	tr	1.29	2.19	=99.24

Density = 2.96.

The Blue Hornblende in the California Schists.—In many of the schists of the Coast Range, Cal., is a blue amphibole that has for some years past gone under the name of glaucophane. Palache[3] has recently found it in large quantities and in well developed columnar crystals in a schist-boulder near Berkely. The matrix of the schist is a granular aggregate of clear, fresh albite, containing numerous liquid and solid inclusions. The latter consist largely of small grains

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

[2] Bull. Geol. Dept. Univ. of Cal., Vol. 1, p. 161.

[3] Ib., Vol. 1, p. 181.

and needles of the blue amphibole. In addition to these are tiny crystals of magnetite, sphene and zircon. In this matrix lie sheaves of the blue amphibole, which are formed of small needles or of large columnar crystals, sometimes measuring as much as 20 mm. in length. The crystals are well developed in the prismatic zone, where they exhibit clearly the cross section of amphibole. The plane of their optical axes is the clinopinacoid. The extinction of the mineral is about 13° to *c*, along the axis of greatest elasticity. The mineral must be closely related to riebeckite. A characteristic feature of the new amphibole is its strong pleochoism, which is stronger even than that of glaucophane. A=sky blue to dark blue; B=reddish to purplish-violet; C= yellowish-brown to greenish-yellow. When broken, crystals of the blue amphibole are often healed with green actinolite, and often fibres of the latter mineral unite portions of blue crystals on opposite sides of veins of albite cutting through the rock mass. An analysis of the blue mineral gave:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	H_2O	Total
55.02	4.75	10.91	9.46	tr	9.30	2.38	7.62	.27	undet.	= 99.70

This indicates a mixture of the three molecules $Na_2 Al_2 Si_4O_{12}$, $Na_2 Fe_2''' Si_4O_{12}$ and $R''SiO_3$ (where R is Mg : Ee : Ca = 6 : 2 : 1) in the proportions 1 : 2 : 9. The optical properties of the mineral are very similar to those of the blue amphibole described by Cross.[4] Chemically, it lies between riebeckite and glaucophane. The author names it crossite.

The Diorites, Gabbros and Amphibolites of Argentina.—The basic rocks from Argentine in the collection of Berlin University have been studied petrographically by Romberg.[5] They occur in the easternmost of the Cordilleran chains, associated with crystalline schists and eruptive rocks. The diorites and gabbros form stocks, and sometimes sills and dykes, that are closely associated with gneiss and crystalline limestones. The author divides the rocks studied into a number of groups and sub-groups, recognizing as the two principal groups eruptive rocks, and those associated with the crystalline schists. Among the undoubled eruptives are gabbros and diorites, and of the latter class there are two varieties, the diorites proper and the quartz diorites. Gabbro-diorites are also recognized among the specimens. The gab-

[4] Cf. American Naturalist, 1890, p. 1073.

[5] Neues Jarb. f. Min. etc., B. B., ix, p. 293.

bros include olivinitic and non-olivinitic varieties. In the former there is often a bluish-green hornblende, at whose contact with feldspar there is often a fringe of spinel arranged in pseudopodia-like masses with their long directions perpendicular to the bounding surfaces of the amphibole. In other specimens the olivine is separated from feldspar by a band of hypersthene. Norites, with reaction-rims around their olivines, and peridotites containing enstatite are among the other members of the gabbro family met with. More closely associated with the schists than all the rocks just mentioned, and apparently forming a portion of the schist series, are diorites, often saussuritized, and amphibolites among the hornblende rocks, and gabbros, peridotites and serpentines among the pyroxene bearing kinds. The basic schistose rocks in the collection studied are schistose diorites, and rocks composed essentially of epidote and zoisite, and of garnet and scapolite, supposed to be derived from diorite, schistose gabbros and hornblende schists. After describing the characteristic features of the gabbro and diorite structures, the author proceeds to discuss the origin of the Argentine hornblende schists. He finds no evidence that these are squeezed plutonic rocks nor metamorphosed sediments, and so he concludes that they are submarine eruptives.

Amphiboles in Russian Rocks.—Federow[6] gives some interesting notes on the amphiboles in the rocks of the northern Urals. The mineral is frequently absent from the freshest rocks. It is most abundantly present in those that have been metamorphosed by pressure. The kinds observed were a yellow-green variety, a colorless or very light colored kind, a dark brown variety, a fibrous variety with a blue color, glaucophane and gastaldite. The first is especially common in gneiss, syenite and syenitic gneiss, and it is present also in a diabase, where it is believed to have been derived from chlorite. The second variety is common to highly metamorphic rocks, while the third is limited to diabases and proterobases. The fourth variety is characteristic of the green schists, more particularly those that have undergone chemical alterations. The glaucophane is found in magnetite schists, in a few altered green schists and in gneiss. The sixth variety is also common to the green schists. In a syenite gneiss the author observed a brown augite that along a zone of crushing has been changed to a light green pyroxene, which is regarded as evidence that dark brown amphibole may give rise by pressure to light green hornblende.

[6] Minn. u. Petrog. Mitth., xiv, p. 143.

Basalt Boulders from Thetford, Vt.—A brief description of the material of the peculiar basalt boulders discovered by Hubbard at Thetford, Vt., is given by Hovey[7] in a recent paper. The most conspicuous features of the boulders are the large masses of olivine and pyroxene scattered through them. The former are in rounded aggregates with a granular structure. Their composition is $SiO_2 = 40.75$, $FeO = 9.36$; $MgO = 50.28$. The pyroxene nodules consist of the remnants of single crystals of a pale green color, and with an extinction of 44°. These nodules are in a groundmass composed of augite, plagioclase, hornblende and several accessory substances. The augite of the groundmass is brownish-violet in color, and it has the peculiarities of basaltic augite.

Maryland Granites.—Keyes[8] argues the original character of much of the epidote in Maryland granites from its close association with allanite, which is believed to be an original component of the rocks, since it occurs in them as sharply defined crystals completely mantled by fresh biotite. It is found also included in crystals of sphene of whose primary nature there can be no doubt. Finally its grains are idiomorphic with respect to many of the original rock components with which they are in contact.

[7] Trans. N, Y. Acad. Sciences, xiii, p. 161.
[8] Bull. Geol. Soc. Amer., Vol. 4, p. 305.